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FORM PTO-1390	DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTORNEY'S DOCKET NUMBER
TRANSMITTAL LETTER TO THE UNITED STATES DESIGNATED/ELECTED OFFICE (DO/EO/US) CONCERNING A FILING UNDER 35 U.S.C. 371		50060-034
		U.S. APPLIC. NO. (if known, see 37 CFR 1.5)
		09/355268

INTERNATIONAL APPLICATION NO.	INTERNATIONAL FILING DATE	PRIORITY DATE CLAIMED
PCT/GB98/00226	January 27, 1998	January 27, 1997

TITLE OF INVENTION

AUDIO COMPRESSION

APPLICANT(S) FOR DO/EO/US

Nicholas Dominic WELLS, Andrew James MASON, John Andrew FLETCHER, and Andrew Kevin MCPARLAND

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.

2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.

3. ☒ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).

4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.

5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
   a. ☐ is transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☒ has been transmitted by the International Bureau (a copy of the Published International Application is transmitted herewith).
   c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US)

6. ☐ A translation of the International Application into English (35 U.S.C. 371(c)(2)).

7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
   a. ☒ are transmitted herewith (required only if not transmitted by the International Bureau).
   b. ☐ have been transmitted by the International Bureau.
   c. ☐ have not been made; however, the time limit for making such amendment has NOT expired.
   d. ☐ have not been made and will not be made.

8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).

9. ☐ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).

10. ☐ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern other document(s) or information included:

11. ☐ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.

12. ☐ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.

13. ☒ A FIRST preliminary amendment.
   ☐ A SECOND or SUBSEQUENT preliminary amendment.

14. ☐ A substitute specification.

15. ☐ A change of power of attorney and/or address letter.

16. ☒ Other items or information.
   International Preliminary Examination Report and Annexes

U.S. APPLIC. NO. (if known, see 37 CFR) 09/355268	INTERNATIONAL APPLICATION NO. PCT/GB98/00226	ATTORNEY'S DOCKET NUMBER 50060-034

	CALCULATIONS	PTO USE ONLY

17. ☒ The following fees are submitted:

Basic National Fee (37 CFR 1.492(a)(1)-(5)):
Search Report has been prepared by the EPO or JPO $840.00

International preliminary examination fee paid to USPTO (37 CFR 1.482) $670.00
No international preliminary examination fee paid to USPTO (37 CFR 1.482)
but international search fee paid to USPTO (37 CFR 1.445(a)(2)) $760.00

Neither international preliminary examination fee (37 CFR 1.482) nor
international search fee (37 CFR 1.445(a)(2)) paid to USPTO $970.00

International preliminary examination fee paid to USPTO (37 CFR 1.482)
and all claims satisfied provisions of PCT Article 33(2)-(4) $96.00

ENTER APPROPRIATE BASIC FEE AMOUNT = **$ 840.00**

Surcharge of $130.00 for furnishing the oath or declaration later than ☐ 20 ☒ 30 months from the earliest claimed priority date (37 CFR 1.492(e)). **$ 130.00**

Claims	Number Filed	Number Extra	Rate	
Total Claims	20 -20 =	0	x $18.00	$
Independent Claims	2 -3 =	0	x $78.00	$
Multiple dependent claim(s) (if applicable)			+ $260.00	$
TOTAL OF ABOVE CALCULATIONS =				$ 970.00

Reduction by 1/2 for filing by small entity, if applicable. Verified Small Entity Statement must also be filed. (Note 37 CFR 1.9, 1.27, 1.28). $

SUBTOTAL = **$ 970.00**

Processing fee of $130.00 for furnishing the English translation later than the ☐ 20 ☐ 30 months from the earliest claimed priority date (37 CFR 1.492(f)). + $

TOTAL NATIONAL FEE = **$ 970.00**

Fee for recording the enclosed assignment (37 CFR 1.21(h)). The assignment must be accompanied by an appropriate cover sheet (37 CFR 3.28, 3.31). $40.00 per property + $

TOTAL FEES ENCLOSED = **$ 970.00**

Amount to be refunded $
charged $

a. ☐ A check in the amount of $ _____ to cover the above fees is enclosed.

b. ☒ Please charge my Deposit Account No. 500417 in the amount of $ 970.00 to cover the above fees. A duplicate copy of this sheet is enclosed.

c. ☒ The Commissioner is hereby authorized to charge any additional fees which may be required, or credit any overpayment to Deposit Account No. 500417. A duplicate copy of this sheet is enclosed.

NOTE: Where an appropriate time limit under 37 CFR 1.494 or 1.495 has not been met, a petition to revive (37 CFR 1.137(a) or (b)) must be filed and granted to restore the application to pending status.

SEND ALL CORRESPONDENCE TO:

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26,527
REGISTRATION NUMBER
July 27, 1999
DATE

BASED ON FORM PTO-1390 (Rev. 5-93)

Docket No.: 50060-034

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of :

Nicholas Dominic WELLS, et al. :

Serial No.: : Group Art Unit:

:

Filed: July 27, 1999 : Examiner:

:

For: AUDIO COMPRESSION

PRELIMINARY AMENDMENT

Assistant Commissioner for Patents
Washington, DC 20231

Sir:

Prior to examination of the above-referenced application, please amend the application as

follows:

IN THE CLAIMS:

Please substitute the attached pages of claims for the claims as filed.

Claim 9, line 1, please change "any one of the preceding claims" to --claim 1--.

Claim 11, line 1, please change "any one of the preceding claims" to --claim 1--.

Claim 18, line 1, please change "any one of claims 1 to 10" to --claim 1--.

REMARKS

The above-referenced application is amended to insert the substitute pages of claims and to delete the multiple dependency of claims 9, 11, and 18 to avoid the multiple dependent claim filing fee.

Respectfully submitted,

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AUDIO COMPRESSION

This invention relates to compressed, that is to say data-reduced or bit-rate reduced, digital audio signals.

5   The invention is applicable to a wide range of digital audio compression techniques; an important example is the so-called "MPEG Audio" coding, defined in ISO/IEC standards IS 11172-3 and IS 13818-3.

In digital broadcasting, certain operations can be performed only on decoded audio signals. There is accordingly a requirement for compression

10   decoding and re-encoding in the studio environment. It is of course desirable that these cascaded decoding and re-encoding processes should involve minimal reduction in quality. Studio operations such as mixing may be conducted on a digital PCM signal, although sometimes there will be a requirement for conversion of the PCM signal to analogue form. In the

15   discussions that follow, attention will be focused on the use of a decoded audio signal in PCM format although it should be remembered that the invention also encompasses the use of decoded analogue signals in analogue form. It will further be appreciated that whilst the digital broadcasting studio environment conveniently exemplifies the present

20   invention, the invention is applicable to other uses of compressed audio signals.

It is an object of the present invention, in one aspect, to provide improved digital audio signal processing which enables re-encoding of a compression decoded audio signal with minimal reduction in quality

25   Accordingly, the present invention consists in one aspect in a method of audio signal processing, comprising the steps of receiving a compression encoded audio signal; compression decoding the encoded audio signal; deriving an auxiliary data signal; communicating the auxiliary data signal with the decoded audio signal and re-encoding the decoded audio signal utilising information from the auxiliary data signal.

Preferably, the auxiliary data signal comprises essentially the encoded audio signal.

In one form of the invention, the auxiliary data signal Is combined with the decoded audio signal for communication along the same signal path as the decoded audio signal.

The invention will now be described by way of example with reference
5   to the accompanying drawings in which:-

Fig. 1 is a block diagram of a digital broadcasting studio installation utilising an embodiment of the present invention;

Fig. 2 Is a block diagram of similar form illustrating a second embodiment of the present invention; and

10   Fig. 3 Is a more detailed block diagram of the operation of the audio decoder (D1) and insertion unit (X) of Fig. 1 when a parity based system Is employed for carrying the auxiliary data.

Referring to Fig. 1, a coded audio bit–stream enters the decoder (D1) at the top left and the decoder produces a linear PCM audio signal, typically
15   in the form of an ITU–R Rec. 647 ("AES/EBU") bitstream, although other forms of PCM signal may be used. The PCM signal is connected to the studio equipment (S) which may provide such facilities as fading, mixing or switching. This connection is made via an insertion unit (X) which combines the auxiliary data signal with the PCM audio signal. Other audio sources are
20   connected to the studio equipment; these are in the form of PCM signals, but some or all of them may previously have been coded, and those decoded locally may be accompanied by auxiliary data signals (e.g. the PCM signal from Decoder D2). The output of the studio equipment is applied to the input of the coder (C) via a signal splitter unit (Y) which
25   separates the auxiliary data from the PCM signal. The output of the coder is a coded (i.e. digitally compressed) audio signal. In Fig. 1, the PCM signal path is represented by the solid line connecting the decoder and coder via the studio equipment. If just a PCM signal arrives at the coder (i.e. the auxiliary data signal is not present) the latter has to perform an independent
30   re–coding process. This introduces impairments in the form of coding artifacts Into the signal (in the case of a PCM signal which has previously been coded, but without the auxiliary signal, these artifacts are additional to

those present as the result of the earlier coding).

In the example of an MPEG audio signal, the most important information to carry with the signal are the positions of the coded audio frame boundaries. These frames are 24ms long when the sampling

5   frequency is 48 kHz.

The build up of impairments can be completely eliminated by avoiding decoding and re-coding wherever possible. For example, if enough of the original coded audio signal is conveyed to the coder, as the auxiliary data signal, the coded audio signal can be reconstituted and substituted for the

10   decoded and re-coded signal. This would require that the studio equipment pass the PCM signal transparently, and that the coded bitstreams to be switched or mixed are frame aligned, or can be brought into frame alignment. Frame aligning can give rise to problems with audio/visual synchronisation ("lip sync") in applications such as television where the video

15   is associated with the audio.

Alternatively, if the auxiliary data signal indicates to the coder the positions in the PCM bitstream of the frame boundaries of the original coded signal, it is possible to minimise any impairment introduced on re-coding if the original groups of audio samples which formed blocks of coded data

20   (e.g. sub-band filter blocks or blocks of samples with the same scale factor) are kept together to form equivalent blocks in the re-coded signal. This does not require frame alignment of coded bitstreams within the studio area, but it does require alignment of the appropriate data blocks within the bitstreams. Such alignment can be effected by the introduction of relatively

25   short delays, which do not significantly affect audio/video synchronisation. Further reductions in the impairment on re-coding may be made if information on the quantisation of the audio in the coded bitstream is conveyed to the coder (C).

A further possibility is to move frame boundaries in the incoming

30   coded bitstreams, whilst preserving the original blocks of coded data, to bring the frames closer to alignment. Relatively short delays can then be used to effect frame alignment by "fine tuning" the timing of the signals.

– 4 –

Frame aligning the coded bitstreams in this way, at a point where the entire incoming coded audio signal is available will minimize further impairment of the audio, and re-coding will take place with the repositioned frame boundaries.

5   If the frame boundaries are repositioned in such a way as to preserve the original block of samples with the same scale factor, only a partial decoding operation is needed. This technique is particularly suited to the editing of bit-rate reduced digital signals because full decoding and re-encoding can be eliminated.

10   In the case where the studio is receiving MPEG audio coded signals in the form of packetised elementary streams (PES), buffer stores in the decoders are used to ensure that the audio signals are correctly timed to a local clock and (if appropriate) to associated video signals, using a programme clock reference (PCR) and presentation time stamps (PTS)

15 within signals. The relatively small adjustments to signal timing needed to align blocks within coded bitstreams entering the studio with the blocks formed by the re-encoding process in the coder (C) may be made either by making some adjustment to the timing in the decoders (D1, D2 etc.) or by introducing delays into the PCM signal paths.

20   In the arrangement of Fig. 1, the auxiliary data takes the same path as the PCM signal through the studio equipment, and is combined with the PCM audio in such a way that it has the minimal effect upon the audio. It is routed with the audio, and if the path is not transparent (e.g. because of fading or mixing) the modification of the auxiliary signal is detected in the

25 coder, and re-coding of the audio proceeds independently of the auxiliary signal. If the path is transparent, the unmodified auxiliary signal facilitates the substitution of the re-coded PCM signal by the original coded signal, or re-coding with the data blocks of the re-coded signal reproducing the blocks of the original signal as closely as possible, as described above. The dotted

30 line of Fig. 1. represents the path taken by the auxiliary data.

Any modification of the signal and associated auxiliary data is detected by appropriate examination of the auxiliary data. For example, the

auxiliary data may be accompanied by error-detecting cyclic redundancy check bits associated with the auxiliary data for each coded audio frame.

Audio signals which have not previously been coded will not be accompanied by any auxiliary data and will be impaired by the coding

5   artifacts introduced by first-time coding when coded by the coder (C). Signals which have previously been coded but for which no auxiliary data is available will be impaired by additional coding artifacts when re-coded by the coder (C).

Although, as explained, the auxiliary data signal can be

10   communicated with the decoded audio signal in any of a number of ways, for ease of understanding, a preferred manner of implementing this will now be described with reference to Fig. 3.

Referring to Fig. 3, the decoder D1 comprises a bitstream interpreter 10 which is arranged to receive a compression encoded audio signal and to

15   interpret it to obtain sample values and coding information, for example, in the case of MPEG-2 audio, bit allocation, scale factors and header information. From this information, a decoded sample is constructed by sample reconstruction element 12, here shown producing a 16 bit sample, but other sample sizes may be employed (either less, e.g. 8 bits, or more;

20   typically for studio applications where high quality is required, 20 or 24 bits may be used). The information concerning the coding is passed to a frame formatting element 14 which combines the information into a data stream of a defined format, to produce the auxiliary data signal. Not shown in the Figure, additional source(s) of data may be present, and this additional data

25   may be formatted and carried together with the coding information. It is to be noted that, apart from the formatting of the auxiliary data, the functions of the decoder may be entirely conventional. The precise arrangement of the auxiliary data is not critical; any convenient format that allows the required information to be extracted may be chosen.

30   The decoded data stream is passed as 16 bit data to the insertion unit (X) which discards the least significant bit, and passes the remaining bits (upper 15 in this case) to a parity calculator 20. The results of the parity

- 6 -

calculation are combined with a single data bit to be coded from the auxiliary
data stream in parity encoder 22 to recreate a 16 bit wide data word in
which the parity of the word encodes a data bit of the auxiliary data signal,
odd for one, even for zero (or vice versa). The resulting (in this case 16 bit)
5   data word may be framed and transmitted serially according to any desired
system, as if it were a "genuine" audio sample. Thus, transmitting the data
signal automatically achieves communication of the auxiliary data signal with
the decoded audio signal.

It will be appreciated that the signal splitter unit Y requires
10   complementary apparatus. In the example of parity based encoding, the
sample data can simply be passed unchanged by the splitter Y (or the least
significant bit can be altered – this makes little difference as the least
15   significant bit no longer carries audio information) and the auxiliary data
provided as the output of a parity checking device operating on the entire
data word. The auxiliary data can then be supplied to a coder for use in re–
coding the decoded signal, for example by using similar quantisation levels.

20   The auxiliary data signal need not be communicated directly with the
decoded audio data, as in the above example, but may be conveyed over a
separate path, as will now be described with reference to Fig. 2.

Referring to Fig. 2, the PCM audio signal takes the same path
through the studio equipment from the decoder (D1) to the coder (C) via the
25   studio equipment (S). However, in this arrangement, the auxiliary data
signal is not combined with the PCM audio but is routed separately. This
arrangement has the advantage that the auxiliary data is not combined with
the PCM audio, and there is no risk of audible changes to the signal as a
result. This might be important, for example, if the studio equipment has
30   only a limited resolution in terms of the audio sample word–length.
Furthermore, the auxiliary data is not modified by fading or mixing. There
are disadvantages in that the auxiliary signal needs to be delayed to keep it

time-aligned with the PCM audio passing through the studio equipment (5), and switching is necessary in the auxiliary data path so that the correct auxiliary data is always presented to the coder (C) with the associated PCM signal. As in the arrangement of Fig. 1, the coder needs to perform re-

5   coding independently of the auxiliary signal at times when the path through the studio equipment (S) is not transparent. One way of ensuring that this happens is for the switch (R) which routes the auxiliary signals the coder to suppress all such signals when independent re-coding is necessary. Another way would be to add a subsidiary auxiliary data signal to the audio

10   passing through the studio equipment (S) which would enable detection of non-transparent processing. This might be, for example, a known pseudorandom binary sequence (prbs) or some form of cyclic redundancy check data on some or all of the audio data.

In Fig. 2, the delay (T) required in the auxiliary data path should be

15   constant, and may be determined by means of suitable tests. However, incoming MPEG audio coded bitstreams in PES form contain PTS, as mentioned previously, and PCM audio signals can carry time information (e.g. the time codes in the ITU-R Rec. 647 signal) which may comprise, or be derived from, the incoming PTS. If the auxiliary signal contains the same

20   information, or the PTS itself, the initial setting of the delay (T) and the subsequent verification of the amount of delay may be performed automatically.

Examples of signals that could comprise the auxiliary data are:

1.   The coded audio signal at the input to the decoder (D1, D2,

25   etc.). This contains not only audio-related data and the PTS but also certain auxiliary information such as programme-associated data (PAD), which may need to be copied into the coded signal at the output from the studio area, and error protection. Depending upon the circumstances, such a signal would enable the coder (C) to

30   substitute the original coded signal for the re-coded PCM signal, or to re-code the PCM signal with blocks of audio data resembling closely

– 8 –

the blocks within the original coded signal, as described above. Conveying the coded audio signal to the coder provides the widest range of options for re-coding with minimal additional impairment of the audio.

5   2. The coded audio samples at the input to the decoder minus the quantised audio samples (which can be re-created identically from the PCM audio signal). This is a signal in which the positions of the frame boundaries of the original coded signal are indicated relative to the linear audio samples in the PCM signal, and from which the

10   positions of the blocks of data within the frames may be deduced, together with information on the allocation of bits to the various components of the coded signal (sometimes known as "bit-allocation data"), scale factors, block lengths (in coding schemes where, this is relevant), the PTS, and any other data relevant to the coding system

15   in use.

3.   A signal similar to that described in "2" above, but containing a subset of the information described (e.g. just the positions of the frame boundaries).

Ways in which the auxiliary data signal might be transported with the

20   PCM audio are:

1.   In the auxiliary sample bits of the ITU-R Rec. 647 bitstream. At the studio standard sampling frequency of 48 kHz, a total bit rate of 384 kbit/s is available in the auxiliary sample bits of both "X" and "Y" subframes. This method is ideal for conveying the auxiliary data

25   between different items of equipment but there is some uncertainty concerning the way in which studio equipment might treat these auxiliary sample bits. For example, the studio equipment may not route these bits through to the output with the PCM audio, or it may

not delay these bits by the same amount as the PCM audio. In either case, some modification of the studio equipment, or of the environment around it, may be necessary.

2.   In the least significant bits (l.s.b.) of the PCM audio sample words of the ITU-R Rec. 647 bitstream. The bits can be inserted into active audio or may be additional bits. Depending upon the resolution of the studio equipment these may the same as the auxiliary sample bits (these are the l.s.b if the Rec. 647 signal is configured to carry 24-bit audio sample words) or the least significant bits within the part of the subframe reserved for 20-bit audio sample words (these are the same bits that carry the 20 most significant bits of 24-bit sample words). As shown in the example illustrated with reference to Fig. 3, the data can be carried as the least significant bit of 16 bit audio. Carrying the auxiliary data in the l.s.b. of the audio sample words overcomes the problems of routing within the studio equipment and care will be taken to ensure that the auxiliary data signal is inaudible. The studio equipment needs to be transparent to audio sample words of at least 20 bits. If necessary, the audibility of the auxiliary data signal could be reduced by scrambling (e.g. by the modulo-2 addition of a pseudorandom binary sequence, or the use of a self-synchronising scrambler). Alternatively, it could be removed altogether by truncating the audio sample words to the appropriate length (i.e. to exclude the auxiliary data).

3.   In the user data bits of the ITU-R Rec. 647 bitstream. Taking the user data bits from both "X" and "Y" subframes provides a channel with a bit rate of only 96 kbit/s. In many applications this is unlikely to be sufficient to carry the complete coded audio signal. It would be sufficient to signal the positions of frame boundaries, and to carry some other information extracted from the coded audio. With this method there is uncertainty concerning the way in which studio

equipment might treat the user data.

4.   In the upper part of the audio spectrum, at frequencies higher
than those of the audible components of the signal. For this purpose,
the PCM audio signal would be low–pass filtered, and the coded
5   auxiliary data signal added above the passband occupied by the
audible signal. A particularly222`ingeniousy of doing this, when the
studio area is receiving MPEG audio coded signals, would be to use
an MPEG analysis subband filterbank with the reciprocal synthesis
filterbank at the insertion units (X) in Fig. 1. At 48 kHz sampling
10   frequency, the audio passband extends almost up to 24 kHz. In
MPEG audio coding this passband is divided into 32 equally–spaced
subbands, each with a bandwidth of 750 Hz. The upper five
subbands are not used, and the audio is thus effectively low–pass
filtered to 20.25 Khz. The auxiliary data could be inserted into the
15   upper subbands, and would be carried in the upper part of the
spectrum of the PCM audio signal, to be extracted by another MPEG
analysis filterbank at the splitter (Y) shown in Fig. 1. The PCM signal
applied to the coder (C) would not need further filtering to remove the
auxiliary data, as this would happen in the analysis filterbank in the
20   coder itself.

5.   The auxiliary signal might be a low–level known pseudo
random binary sequence (prbs) added to the audio. The prbs would
be synchronised in some way with the audio frame boundaries and
may be modulated with additional data where possible. It is also
25   possible to subtract the prbs from the data prior to final transmission
or monitoring.

It has been explained that under certain circumstances it is
appropriate to perform partial decoding and re–encoding. In the appended
claims the terms decoding and re–encoding should be taken as including
30   partial decoding and re–encoding, respectively.

CLAIMS

1. A method of audio signal handling, comprising the steps of receiving a compression encoded audio signal and compression decoding the compression encoded audio signal to produce a decoded audio signal,

5 characterised in that the method further comprises: deriving an auxiliary data signal relating to the compression encoded audio signal; communicating the auxiliary data signal together with the decoded audio signal and re-encoding the decoded audio signal utilising information from the auxiliary data signal.

2. A method according to Claim 1, wherein the auxiliary data signal
10 comprises all or part of the encoded audio signal.

3. A method according to Claim 2, wherein the auxiliary data signal comprises audio-related data from the encoded audio signal.

4. A method according to Claim 3, wherein the auxiliary data signal comprises time information from the encoded audio signal.

15 5. A method according to Claim 4, wherein the auxiliary data signal further comprises ancillary information, such as program-associated data, from the encoded audio signal.

6. A method of audio signal handling, comprising the steps of receiving a compression encoded audio signal and compression decoding the
20 compression encoded audio signal to produce a decoded audio signal, characterised by the further steps of: deriving an auxiliary data signal indicative of the analysis and quantisation employed for the compression encoded audio signal; communicating the auxiliary data signal together with the decoded audio signal and re-encoding the decoded audio signal utilising information
25 from the auxiliary data signal to produce a re-encoded audio signal employing the same analysis and quantisation as the encoded audio signal.

7.   A method according to Claim 6, wherein the analysis comprises application of a sub-band filter bank.

8.   A method according to Claim 7, wherein the auxiliary data signal is indicative of the frequency analysis into sub-bands and the method of quantisation within each sub-band employed for the encoded audio signal frequency.

9.   A method according to any one of the preceding claims, wherein the encoded audio signal is an MPEG audio coded signal.

10.   A method according to Claim 9, wherein the auxiliary data signal contains information relating to one or more of: the position of audio frame boundaries in the encoded audio signal; frequency sub-bands; scale factors for the sub-bands within each audio frame of the encoded audio signal; bit allocation data for each audio frame of the encoded audio signal.

11.   A method according to any one of the preceding claims, wherein the auxiliary data signal is combined with the decoded audio signal for communication along a common signal path with the decoded audio signal.

12.   A method according to Claim 11, wherein the auxiliary data signal is formatted to enable an integrity check prior to use of the auxiliary data signal in a re-encoding process, to ensure transparent communication of the auxiliary data signal along a decoded audio signal path.

13.   A method according to Claim 11, wherein the auxiliary data signal is carried in the least significant bits of a digital decoded audio signal.

14.   A method according to Claim 11, wherein the auxiliary data signal is carried as user data bits in a recognized digital interface format.

15.   A method according to Claim 11, wherein the auxiliary data signal is carried in the upper part of the audio spectrum.

16.   A method according to Claim 15, wherein the auxiliary data signal is carried in higher frequencies associated with sub-bands unused in the

5   compression encoding.

17.   A method according to Claim 16, in which MPEG audio coding is employed, wherein a filter arrangement analogous to the MPEG analysis sub-band filter arrangement and its reciprocal, is employed for insertion of the auxiliary data signal into the decoded audio signal.

10   18.   A method according to any one of Claims 1 to 10, wherein the auxiliary data signal is carried in a separate path to the decoded audio signal.

19.   A method according to Claim 18, wherein the auxiliary data signal path is disabled in the event of processing of the decoded audio signal preventing sensible use of information from the auxiliary data signal in re-encoding.

15   20.   A method according to Claim 19, wherein a tell-tale is added to the decoded audio signal indicative of such processing.

Fig. 1

Fig. 2

2/2

Fig. 3
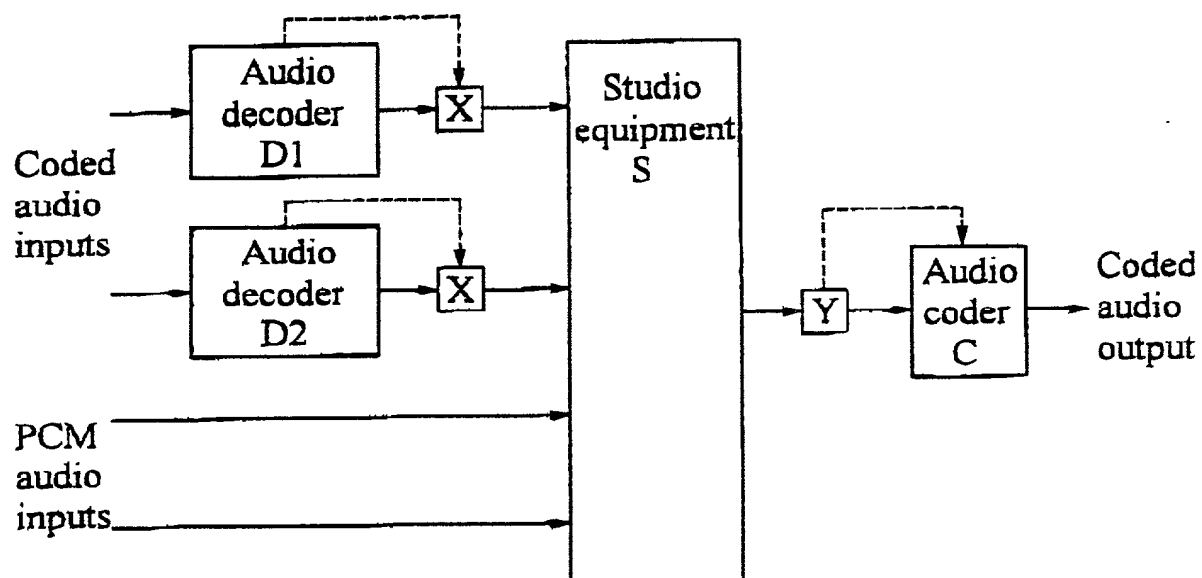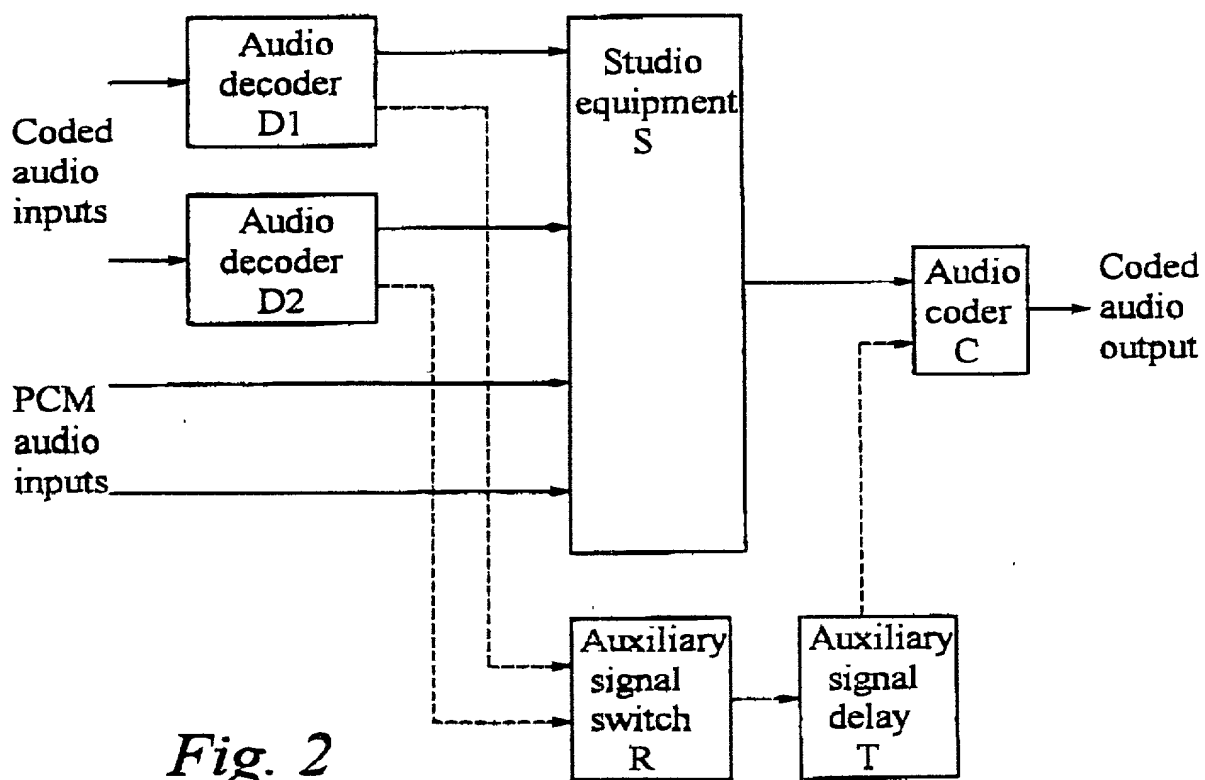
COMBINED DECLARATION FOR PATENT APPLICATION AND POWER OF ATTORNEY (Includes Reference to PCT International Application(s)	Attorney's Docket Number 50060-034

As below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below next to my name,

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled:

AUDIO COMPRESSION

the specification of which:

☐   is attached hereto.

☒   was filed as United States application Serial No.   09/355,268

      on   July 27, 1999

      and was amended on   (if applicable).

☐   was filed as PCT international application Number

      on

      and was amended under PCT Article 19 on   (if applicable).

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is known to me to be material to patentability in accordance with Title 37, Code of Federal Regulations, §1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, §119(a)-(d) or Section 365(b) of any foreign and/or international application(s) for patent or inventor's certificate or Section 365(a) of any PCT international application(s) designating at least one country other than the United States of America listed below and have also identified below any foreign application(s) for patent or inventor's certificate or any PCT international application(s) designating at least one country other than the United States of America filed by me on the same subject matter having a filing date before that of the application(s) of which priority is claimed:

PRIOR FOREIGN/PCT APPLICATION(S) AND ANY PRIORITY CLAIMS UNDER 35 U.S.C. 119:

COUNTRY (If PCT, indicate "PCT")	APPLICATION NUMBER	DATE OF FILING (day, month, year)	PRIORITY CLAIMED UNDER 35 USC 119
GREAT BRITAIN	9701616.6	January 27, 1997	☒Yes ☐ No

I hereby claim the benefit under 35 USC §119(e) of any United States provisional application(s) listed below.

PRIOR PROVISIONAL APPLICATION(S):

Application Number	Filing Date

I hereby claim the benefit under Title 35, Unite___ ___es Code, §120 of any United States application(s), or §___ ___ of any PCT international application(s) designating the United States of America that is/are listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

PRIOR U.S. APPLICATIONS OR PCT INTERNATIONAL APPLICATIONS DESIGNATING THE U.S. FOR BENEFIT UNDER 35 U.S.C. 120:

U.S. APPLICATIONS		STATUS (Check One)		
U.S. Application Number	U.S. Filing Date	Patented	Pending	Abandoned

PCT APPLICATIONS DESIGNATING THE U.S.					
PCT Application No.	PCT Filing Date	U.S. Serial Numbers Assigned (if any)			
PCT/GB98/00226	January 27, 1998				

POWER OF ATTORNEY: As named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: Edward A. Becker, Reg. No. 37,777; Stephen A. Becker, Reg. No. 26,527; Marcel K. Bingham, Reg. No. 42,327; John G. Bisbikis, Reg. No. 37,095; Carl L. Brandt, Reg No. P44,555, Daniel Bucca, Reg. No. 42,368; Kenneth L. Cage, Reg. No. 26,151; Stephen C. Carlson, Reg. No. 39,929; Jennifer Chen, Reg. No. 42,404; Thomas A. Corrado, Reg. No. 42,439; Lawerence P. Cullen, Reg. No. P-44,489; Paul Devinsky, Reg. No. 28,553; Laura A. Donnelly, Reg. No. 38,435; Margaret M. Duncan, Reg. No. 30,879; Brian E. Ferguson, Reg. No. 36,801; Michael F. Fogarty, Reg. No. 36,139; Willem F. Gadiano, Reg. No. 37,136; Keith E. George, Reg. No. 34,111; John A. Hankins, Reg. No. 32,029; Brian D. Hickman, Reg. No. 35,894; Joseph Hyosuk Kim, Reg. No. 41,425; Eric J. Kraus, Reg. No. 36,190; Patrick B. Law, Reg. No. 41,549; Jack Q. Lever, Reg. No. 28,149; Raphael V. Lupo, Reg. No. 28,363; Christine F. Martin, Reg. No. 39,762; Michael A. Messina, Reg. No. 33,424; Eugene J. Molinelli, Reg. No. 42,901; Christopher J. Palermo, Reg. No. 42,056; Joseph H. Paquin, Jr., Reg. No. 31,647; Robert L. Price, Reg. No. 22,685; Thomas D. Robbins, Reg. No. 43,669; Gene Z. Rubinson, Reg. No. 33,351; Joy Ann G. Serauskas, Reg. No. 27,952; David J. Serbin, Reg. No. 30,589; Glenn Snyder, Reg. No. 41,428; David A. Spenard, Reg. No. 37,449; Arthur J. Steiner, Reg. No. 26,106; David L. Stewart, Reg. No. 37,578; Michael D. Switzer, Reg. No. 39,552; Leonid D. Thenor, Reg. No. 39,397; Keith J. Townsend, Reg. No. 40,358; Leon R. Turkevich, Reg. No. 34,035; Christopher D. Ward, Reg. No. 41,367; Cameron K. Weiffenbach, Reg. No. P-44,488; Aaron Weisstuch, Reg. No. 41,557; Edward J. Wise, Reg. No. 34,523; Alexander V. Yampolsky, Reg. No. 36,324; and Robert W. Zelnick, Reg. No. 36,976 , all of McDermott, Will & Emery.

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I hereby declare that all statement made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signature of Inventor 201: N. D. Wells	Signature of Inventor 202: AJ Mason	Signature of Inventor 203: John A. Fletcher
Date 18. November 99 18.11.99	Date 16th November 1999	Date 6th December 1999

(4)
over

I hereby claim the benefit under Title 35, United States Code, §120 of any United States application(s), or §_____ of any PCT international application(s) designating the United States of America that _____ listed below and, insofar as the subject matter of each _____ claims of this application is not disclosed in that/those prior application(s) in the manner provided by the first paragraph of Title 35, United States Code, §112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, §1.56 which occurred between the filing date of the prior application(s) and the national or PCT international filing date of this application.

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U.S. APPLICATIONS		STATUS (Check One)		
U.S. Application Number	U.S. Filing Date	Patented	Pending	Abandoned

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	Residence and Citizenship	City	State or Foreign Country	Country of Citizenship
	Post Office Address	Post Office Address	City	State & Zip Code/Country

I hereby declare that all statement made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

Signature of Inventor 204: A. McParland	Signature of Inventor 205:	Signature of Inventor 206:
Date 18TH NOVEMBER 1999	Date	Date